



Recovery of Fingerprint Ridges from Crime Scene; Percentile of Actual Implemented Ridges Details in Each Quadrant And its Feasibility

Rhythm Gandhi¹, Amit Chauhan^{*2}, S. K. Shukla³

^{1,2,3}Amity Institute of Forensic Sciences, Amity University, Noida, Sector-125, Uttar Pradesh- 201313, India.

ABSTRACT

Aim: To determine the actual percentage of partial or complete fingerprints from each quadrant that are recovered from the crime scene.

Methodology: In this study, 100 samples including male and female were collected from the population of Haryana from the age group 18-35 years at the temperature 18-35°C. All lateral fingerprints were collected on white A4 sheet by applying black fingerprints ink over the fingers. For examination of sample, 10 X lens and for statistical evaluation SPSS software latest version 17.0 was used.

Result: It was observed that the females have similar number of ridges in thumb as the males had. Composure of the fingers have a slight bit variation present in the male study.

Discussion: As the resultant of the present study, it was observed that thumb impression, little finger impression for both of genders shows the significant difference of their presence over any surface. The ridge details show that females have highly significant lesser number of ridges in comparison of males. In both of fingers (thumb and little finger) both of genders, females have high chances in which no. of ridges may be absence.

Conclusion: This study may be useful to get an idea about the gender and to get an idea about the finger from which it may be implemented over the object.

Key Words: Fingerprints ridges, Gender discrimination, Crime scene, Percentage, Feasibility etc

INTRODUCTION

In last few decades, investigation and identification procedure to an individual has changed; the modern technology has taken over the traditional process of investigation^{(1) (3)}. In this era of advancement, since the digitalization has minimized time duration of process yet⁽²⁾, we do the final submission after manual examination in few of forensic aspects i.e. fingerprints, questioned documents etc. fingerprints and palm prints which are perpetual, unique and ubiquitous by nature, i.e. play a vital role in identification of an individual and investigation^{(4) (5)}. These finger prints, palm prints carry tremendous information about suspect, gender, an approximation of the age. numerous Scientists and scholars carried

out a lot of research over finger prints and palm prints over distinct populations⁽⁶⁾.

As per the existing studies of scientists, these prints are recovered in various forms and only few details are noticed. When someone writes, prepare of work of art, or take the support of wall and the ridge and furrows of the palm that have sweat pores which keep them moist. Individual put their hands against the surfaces, nobody help them to support or facilitate the movement of hands and unknowingly their identity left behind over the surface in latent form^{(7) (8)}. By this time, it has been observed that only a few ridges are encountered belong to any part of palmar surface⁽⁹⁾. When an individual put their hand against any surface, the outer edge of thumb, tip point of index finger, while the middle portion

Corresponding Author:

Amit Chauhan, Amity Institute of Forensic Sciences, Amity University, Noida, Sector-125, Uttar Pradesh- 201313, India;
Ph: +91-9540067484; Email: amit_chauhan777@yahoo.in

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of middle finger and ring finger comes in the contact of that surface. In case of little finger, it repeats the same manner like of thumb and only outer edge details are recovered from surfaces⁽¹⁰⁾. It is frequently observed that partial information is obtained from the intensified prints and the identity left often in question.

According to a research of federal Bureau of Investigation, the probability of any similarity in two fingerprints is about 1.9×10^{15} which is very rare and have not reported yet. This study was conducted to obtain an information about the implementation of ridge details over any object and to determine the portion of any finger⁽¹¹⁾. Will the implementation give any discrimination between two genders? Or both of genders will have equal probability for implementation of their fingerprints ridges over any surface. For which all the ten fingerprints were divided in to four quadrants (1st, 2nd, 3rd and 4th quadrant) from the center of pattern because of any occurrence of ridge, only middle portion is recovered.

METHODOLOGY

In this study, 100 samples including male and female were collected from the population of Jharoda, Najafgarh areas of Haryana from the age group 18-35 years. All the samples were collected from March -April 2017 at the temperature in between 18-35° C. All the subjects were informed about the purpose of study and consent was taken earlier. Samples were collected by simple random sampling method⁽¹²⁾. All the samples were preserved in simple A4 size Brown envelope at room temperature to avoid any kind of degradation such as moisture, dirt. To determine the percentile of samples, each fingerprint samples were divided into four quadrants from the center of pattern. Shown below in figure-1.

All lateral fingerprints were collected on white A4 sheet by applying black fingerprints ink over the fingers. Subjects were asked to implement their fingerprints as such as it is put over any documents without following any specific manner. All the samples were preserved for further analysis procedure. For examination of sample, 10 X lens was used and all samples were photographed with the help of Samsung 7s model -13 mega-pixel camera. For statistical evaluation SPSS software latest version 17.0 was used. A hypothesis was established for the conclusion of result whether, the occurrence of all quadrants will implement in equal proportion or only a few ridges from any quadrant will present.

RESULT

This study is mainly focused to study the occurrence of quadrant of fingers which is confronted at scene. When a left- handed person takes support of

wall, write over a writing surface or prepare work of art, the outer edge of thumb (2nd& 4th quadrant) comes in the contact of surface⁽¹³⁾ (14). While in Index finger, all four quadrants have equal chance of occurrence, in Middle finger, ring and little finger have equal proportion of occurrence. The proportion of a male left-handed person's ridge details are given below in table No.-1 below

When the male individual is right-handed, in that case the chances of a finger quadrant occurrence changes. During the study of ridge detail of a thumb prints, the quadrant (1st& 4th) have most probability of occurrence while in rest of finger it is almost similar. The ridge details for a right handed subject is given below in table no-2.

During this study, it was observed that the females have similar number of ridges in thumb as the males had. Composure of the fingers have a slight bit variation present in the male study. The dossier for left-handed female is given below in table no.-3

The dossier for right-handed female has some similarity like of right-handed males. The details are given below in table no-4-

DISCUSSION

According to this study, the males of both of handed show 100% chance of higher probability of ridge details in 2nd and 4th quadrant of left hand's thumb while less probability in 1st and 3rd of right hand's thumb⁽¹⁵⁾. Whereas, only 4% population showed the presence of ridge details of fingerprints in 1st quadrant of thumb and only 6% population showed the presence of ridges in 3rd quadrant of thumb. For index finger, male showed 100% presence of 1st and 3rd quadrants whereas 6% population showed the absence of ridges in 2nd and 4th quadrant. In analogous manner, middle finger's ridges showed 100% presence in 1st and 3rd quadrants present in the whole selected samples whereas only 4% population showed the absence of the 2nd and 4th quadrants. The ring finger shows the similar percentage of ridges as in middle finger, it was 100% of all the quadrants were present in the ring finger while for little finger 2% for 1st quadrant, 14% for 2nd quadrant, 4% for the 3rd and 14% for the 4th quadrant showed the absence, in the left hand.

In the dossier of right-handed males, the percentage was only 2% in 2nd and 4th quadrant of samples in thumb while for 1st and 3rd quadrant 100 % occurrence was observed. For index finger, the presence of ridges in 1st& 3rd quadrant was 82% while in 2nd 100% ridges were present and in 4th quadrant 4% ridges were absence. In case of middle finger, 100% ridge details were observed in 1st, 2nd and 3rd quadrant while in 4th quadrant only 6% ridges were absence. In 1st and 3rd quadrant

of ring finger showed the presence of 100 % ridge details while in 2nd and 4th only 4% were absence. For little finger of right handed males, in 1st quadrant 2% ridges were absence while in 2nd and 4th quadrant shows 4% of absence and 6% ridges were absence in 3rd quadrant of fingers.

According to the dossier of this study, there is 100% chance of showing higher probability of ridge details in 2nd and 4th quadrant of the right hand's thumb while less probability; 2% only in 1st and no occurrence of 3rd quadrant of the right hand's thumb. For index finger, male showed 96% & 94% presence of ridges in 1st and 3rd quadrants whereas 12% and 8% population showed the absence of ridges in 2nd and 4th quadrant. In analogous manner, middle finger's ridges showed 100% presence in 1st and 3rd quadrants present in the whole selected samples whereas only 6%, 4% population showed the absence of the 2nd and 4th quadrants.

The ring finger distinguish percentage of ridges as in middle finger, it was 96% for 1st quadrant, 94% for 2nd and 3rd quadrant and 100% for 4th quadrant. For little finger 10% for 1st quadrant, 10% for 2nd quadrant, 6% for the 3rd and 10% for the 4th quadrant showed the absence, in the left hand.

In the dossier of right-handed females, the percentage of ridges were; 98% and 100% in 2nd and 4th quadrant of the samples in thumb while for 1st and 3rd quadrant 100 % occurrence was observed. For index finger, the presence of ridges in 1st & 3rd quadrant was 90% & 98% while in 2nd 90% ridges were present and in 4th quadrant 90% ridges were present. In case of middle finger, 94%, 98% and 92% ridge details were observed in 1st, 2nd and 3rd quadrant while in 4th quadrant 100% ridges were present. In 1st and 3rd quadrant of ring finger showed the presence of 98 & 96% ridge details while in 2nd and 4th only 2% and 8% were absence. For little finger of right handed males, in 1st quadrant 14% ridges were absence while in 2nd and 4th quadrant shows 2, 12% of absence and 8% ridges were absence in 3rd quadrant of fingers.

CONCLUSION

Fingerprints, palm and sole prints are used to establish the identity of an individual since so long in the history of investigation⁽¹⁶⁾. Implementation of tremendous change in traditional methods and advancement has changed the investigation procedure of crime scene. A lot of studies have been carried out for the gender discrimination over various population in India, although these studies dealt with the information obtained from the tip of fingers while at scene of occurrence only a part of prints is encountered⁽¹⁷⁾. Often, the outer part of thumb impression and inner part of index finger is encountered in various forms are observed. If the ridges are examined carefully and the investigator could determine the hand/ finger to which the ridges belongs, it will be helpful for investigation and no suspect will be able to escape

from nabbing. Identification can be done based-on minutiae details among the ridges selected in an area followed by international standard. It will further help the analysts to direct search a particular gender will eventually save the time of investigating officer.

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REFERENCES

1. Caplan R.M. How fingerprint came into use for personal identification. J Am Acad. Dermatol. Vol. 23 issue 1 (1990), Pp; 109-14.
2. Subrahmanyam B.V. Personal Identity. Modi's Medical Jurisprudence and Toxicology 22nd Edition. Butterworths, New Delhi. 2001, Pp; 37-90.
3. Rutty GN, Stringer K, Turk EE. Electronic fingerprinting of the dead. International Journal of Legal Medicine. 2007 Feb 13; Epub. ahead of print.
4. Amit Chauhan, Jyoti Singh, Identification of an individual from the latent palm prints present on documents International journal of Research Science & Innovation, Vol. 1 Issue VII, pp-29-35, 2014.
5. Amit Chauhan, Jyoti Singh, K.P.S. Kushwaha An Evaluation; Sexing from the Ridge density of latent palm prints of North Indian population, Research Journal of Recent Science, Vol-4, Pp-73-75, 2015 .
6. Wang Y, Hu J, Phillips D. A Fingerprint Orientation Model Based on 2D Fourier Expansion (FOMFE) and its application to Singular-Point Detection and Fingerprint Indexing. IEEE Trans Pattern Anal Mach Intell. Vol 29 Issue 4 (2007), Pp; 573-85.
7. Jain A.K, Chen Y, Demirkus M. Pores and ridges: high-resolution fingerprint matching using level 3 features. IEEE Trans Pattern Anal Mach Intell. Vol. 29 issue 1 (2007) Pp; 15-27.
8. Amit Chauhan, Aditi Chauhan, Dr. Jyoti Singh, Dr. S. K. Shukla. A correlative study between the implementation of rhythmic system and hieroglyphicssubstantial's. International Journal of current research and review. Vol 9 Issue 9 (2017). Pg; 1-05.
9. Amit Chauhan, Aparna Gautam, Sourabh Kumar Singh, Dr. S. K. Shukla. Gender inequity from the quadrant of lateral fingerprints among the age group of 18-25 years from the population of National capital region of India. International journal of civil engineering and technology. Vol. 8 Issue 4 (2017). Pg; 1402-1407.
10. Lin SS, Yemelyanov KM, Pugh ENJR, Engheta N. Polarization-based and specular-reflection-based noncontact latent fingerprint imaging and lifting. J Opt Soc Am A Opt Image Sci Vis. Vol 23 issue 9 (2006), Pp; 2137-53.
11. Acree Mark A. Is there a gender difference in fingerprint ridge density? Forensic Science International. Vol 102 (1999), Pp:35-44.
12. Grieve MC, Dunlop J. A practical aspect of the Bayesian interpretation of fibre evidence. J Forensic Science Society. Vol. 32

(1992), Pp:169-75.

13. Plato C.C, Cereglino JJ, Steinberg FS. The Dermatoglyphics of American Caucasian. Am J Phy Anthropol. Vol 42 (1975), Pp:192-210.
14. Cummins H, Midlo C. Fingerprints, Palms and Soles. An introduction to dermatoglyphics, Dover Publ, New York, 1961:272.
15. Amit Chauhan, Varsha Chauhan. An expansion of indented signatures over the credential by the employment of domiciliary commodity. International journal of civil engineering and technology. Vol 8 Issue 4 (2017). Pg; 1960-1966.
16. Moore R. T. Automatic fingerprint identification systems. In H.C. Lee, R.E. Gaensslen (Eds.) Advances in Fingerprint Technology, CRC Press, Boca Raton, FL, 1994:169.
17. Okajima M. Frequency of fork in epidermal ridge minutiae in fingerprint. Am J Phys Anthropol. Jan-May Vol 32 (1970), Pp:41-8.

Table 1: Male fingerprints ridge detail from each quadrant of left hand.

Quadt.	Male Left- Hand Finger prints																			
	Thumb				Index				Middle				Ring				Little			
	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd
Total	2	50	3	50	50	42	50	42	50	48	50	48	50	50	50	50	49	43	48	43
%	4	100	6	100	100	84	100	84	100	96	100	96	100	100	100	100	98	86	96	86

Table 2: Male Fingerprints ridge detail from each quadrant of right hand.

Quadt.	Male Right hand fingerprints																			
	Thumb				Index				Middle				Ring				Little			
	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd
Total	50	1	50	1	41	50	41	48	50	50	47	50	50	49	49	48	49	48	47	48
%	100	2	100	2	82	100	82	96	100	100	94	100	100	98	98	96	98	96	94	96

Table 3: Female fingerprints ridge detail from each quadrant of left hand.

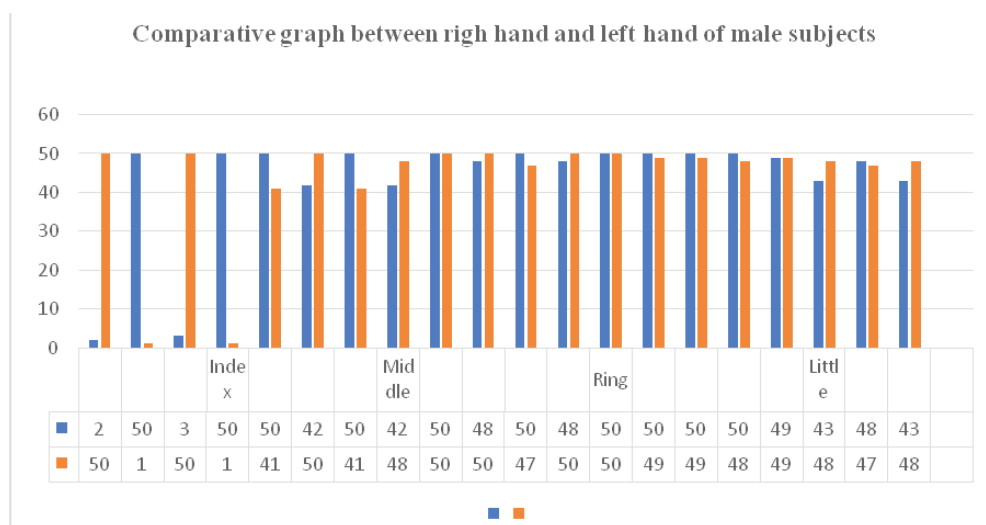
Quadt.	Female Left-hand fingerprints																			
	Thumb				Index				Middle				Ring				Little			
	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd
Total	1	50	1	50	48	44	47	46	50	47	50	48	48	47	47	50	45	45	47	45
%	2	100	2	100	96	88	94	92	100	94	100	96	96	94	94	100	90	90	94	90

Table 4: Female fingerprints ridge detail from each quadrant of Right hand.

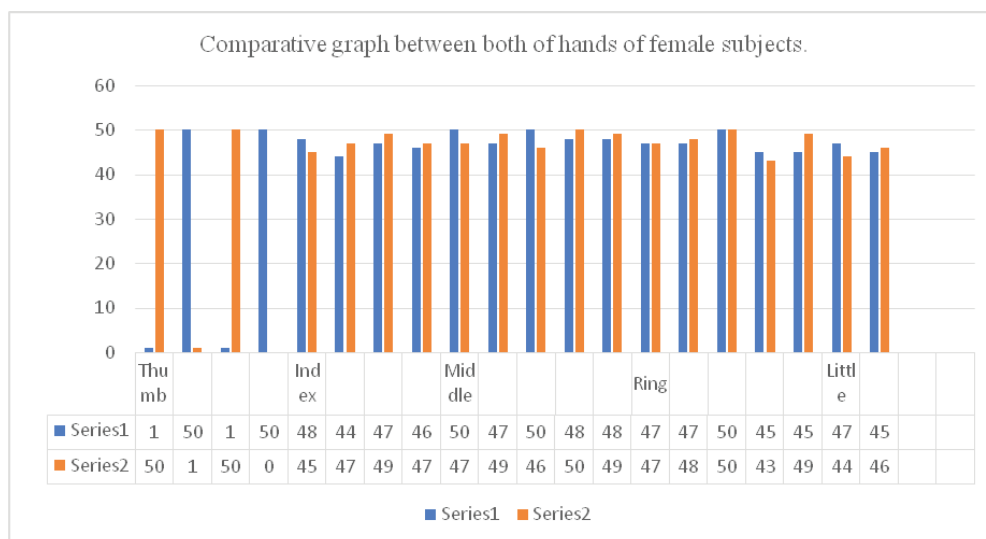
Quadt.	Female Right-hand fingerprints																			
	Thumb				Index				Middle				Ring				Little			
	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd	1 Qd	2 Qd	3 Qd	4 Qd
Total	50	1	50	0	45	47	49	47	47	49	46	50	49	47	48	50	43	49	44	46
%	100	2	100	0	90	94	98	94	94	98	92	100	98	94	96	100	86	98	88	92



Figure 1: Fingerprint divided in to four quadrants from the center of pattern.



Graph 1: The comparative study between both of hands of male subjects.



Graph 2: The comparative study between both of hands of female subjects.